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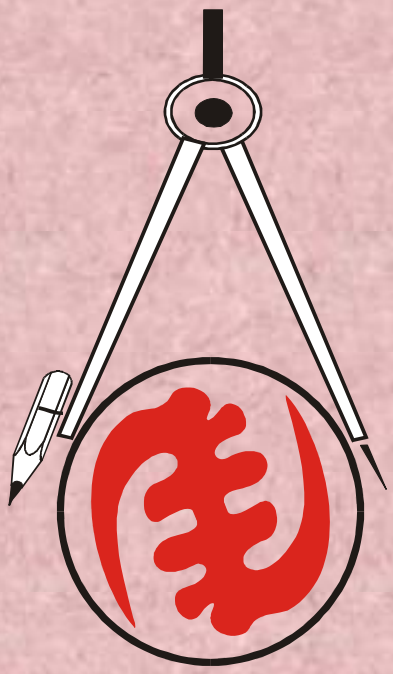

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MATHEMATICS CONNECTION aims at providing a forum to promote the development of Mathematics Education in Ghana. Articles which seek to enhance the teaching and/or learning of mathematics at all levels of the educational system are welcome.

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RESOLUTION ADOPTED AT THE 26TH BIENNIAL NATIONAL WOKSHOP/CONFERENCE

The 26th Biennial National Workshop/Conference of the Mathematical Association of Ghana (MAG) was held at the St. James Seminary, Sunyani, from 24th to 28th of August, 1998, on the theme, *The role of Mathematics in the FCUBE'*.

The Communiqué below, which was adopted at the end Conference, was presented to the Director-General of the Ghana Education Service, on Thursday, October 1, 1998, at the GES Headquarters, Accra.

At the 26th Biennial National Workshop/Conference of the Mathematical Association of Ghana (MAG), concerns were raised on the following:

- Poor performance of majority of students in mathematics at the basic and Senior Secondary levels;
- The declining performance level of the girl child as she goes up the ladder;
- Insensitivity of the mathematics curriculum to developments in technology;
- Qualification of teacher trainees in mathematics.

It was observed that;

i. the syllabi are over loaded considering he scope of work included and the time provided, besides the level of the syllabi is higher that what the majority of students can cope with;

ii. the syllabus is silent over oral and mental drills that facilitate recall of basic number facts;

iii. most of the teaching/learning materials required in schools are not available;

iv. teachers are not adequately motivated;

v. there is inadequate supply of mathematics teachers making the workload of the few who handle ad subject unbearable;

vi. the majority of teacher trainees and beginning teachers have very weak knowledge base in mathematics;

vii. in spite of the fact that STME clinics' started about 10 years ago very little improvement has been noticed in the proportion of girls doing well in mathematics;

viii. very little is said in the syllabus about the use of new technological devices such as digital watches, calculators, computers, etc., which can enhance the teaching and learning of mathematics.

In view of the above concerns, the MAG at its 26" annual General Meeting resolve that:

1. the syllabus for basic and SSS should be reviewed, should ensure that the needs of all types of students at the Secondary level are adequately met;
2. the GES must institute measures to make teachers use teaching activities that will enable the full development of students' verbal' and 'mental' abilities in mathematics so as to ensure quick recall of basic number facts;
3. Mathematics laboratories should be set up at all district centres to serve as models for schools to know the materials required for teaching/learning mathematics. The materials should include properly manufactured teaching/learning materials and

not only these improvised by teachers;

4. More mathematics teacher should be involved in the STME programmes (or activities);
5. The Ministry of Education should come out with clear policy regarding the use of technological devices such as digital watches, calculators, computers etc. In our schools;
6. Mathematics teachers should be adequately motivated by offering them special allowances;
7. Intake (or enrolment) to courses leading to Diploma and B. ED in mathematics should be increased;
8. The minimum requirements for entry in to the training college should be raised from 'E' to 'D' for mathematics.

6th National Delegates Workshop & Conference Ends at Denu

The 6th National Delegates Workshop/Conference of the Mathematical Association of Ghana (MAG) ended in Denu in the Volta Region on August 29, 1999. The Conference was opened by the District Chief Executive of the Ketu District, Mr. Aheto, at 10.00 a.m. on Tuesday, 25th August, 1999. It was attended by 112 delegates and officers of the association.

The chief host, Mr. F. K. Alorgbe, the Volta Regional Chairman of the association, and his able executive worked diligently to ensure the success of the conference. They were supported by the greater Accra Executive. This was the second time the association has held its delegates conference in the Region.

The *Keynote Address* was delivered by the Ketu District Chief Executive, Mr. Aheto. The Headmaster of the host school – St.Paul's Secondary School, Hatsukope Viepe/Aflao – Mr. P.R.M. Deku, presented the *Welcome Address*. Dr. B. A. Eshun, a senior lecturer of the University of Cape Coast, delivered the *Presidential Address*. Other lead papers were presented by Dr. Kofi Mereku of the University College of Education of Winneba, and Mr. D. M. K Dotse, Headmaster of Three-Town Secondary School, Denu.

This issue of the MAG Newsletter features some of the major papers presented at the conference.

Plenary session discussions on the basic and senior secondary school syllabuses and mathematics examinations were led by Mr. J. F. K. Appiah-Cobbold, Mr. E. B. Dogbe and Mr. I. A. Ahinful. The Editor, Dr. Kofi Mereku, distributed to participants the Issue 9, of the MAG Newsletter. He appealed to members to make contributions to the newsletter in the form of articles.

At the evaluation meeting held by the executive after the conference, it was agreed that the next National General Workshop/Conference marks the association's 40th anniversary, and for that matter must be well celebrated and also given an international dimension.

Presidential Address of the 26th National General Workshop/Conference at Sunyani

The Role Mathematics in the FCUBE Programme

MR. S.E. AMISSAH

PAPER DELIVERED AT THE 26TH NATIONAL GENERAL WORKSHOP/CONFERENCE OF THE MATHEMATICAL ASSOCIATION OF GHANA (MAG), AUGUST 24 – 29, 1998, AT ST. JAMES' SEMINARY/SECONDARY SCHOOL, SUNYANI

The Chair, Mathematical Association of Ghana,
Member of the Executive Committee,
Council Members,

Participants
Distinguished Ladies and Gentlemen!

Let me first of all apologise sincerely for my inability to be with you at the 25th National General Workshop/Conference held at Mfantsipim School, my alma mater. This was due to unforeseen circumstances entirely beyond my control.

I am however happy to be with you today and to be part of this Conference. 1 wish also to express my grateful thanks and appreciation for the honour done me in re-electing me as the President of this great Association and for the invitation to deliver the Presidential address under the theme: "The Role Mathematics in the FCUBE Programme". The theme is both relevant and challenging to us as an Association.

As you may be aware, the FCUBE initiative is the Ministry of Education's response to a constitutionally mandated charge. Article 39 (2), of the 1992 Constitution of the Fourth Republic of Ghana states:

> The Government shall, within two years after Parliament first meets after coming into force of this constitution, draw up a programme for implementation within the following ten years, for the provision of Free, Compulsory and Universal Basic Education.

I wish however to caution that this is not a new animal unrelated to the on-going educational reforms. It is still a part and the objectives of the new educational reforms are still applicable, among which are:

1. To increase access
2. To improve quality of education
3. To improve efficiency

Compare these with the four strategic objectives of FCUBE which are:

1. To improve quality **of** teaching and learning
2. To increase access and participation
3. To improve management efficiency and sustainability within the Education Sector
4. To decentralise the management of the Education system.

I must add here that a start had already been made towards the fourth objective in the 1987 Education Reform Programme by the upgrading of the rank of the District Head from Assistant Director to Director.

FCUBE is thus a reinforcement of the new educational reforms with the emphasis also on the requirement that all children of school going age should compulsorily go to school and remain in school up to the end of the basic education level. This no doubt has implications for the school curriculum which is expected to develop in pupils the following amongst others:

i. skills of listening, speaking, reading and writing;

ii. knowledge of the principles and skills of numeracy, measurement and of relationships involving space and shape;
iii. research and study skills as well as skills of inquiry, analysis and knowledge of healthy living.

Putting it in another way, the pupil should be helped to

a. think creatively;
b. communicate thought effectively;
c. discriminate among values;
d. make relevant judgements;
e. gain a skill in adding to his previous knowledge
f. find self-expression in and create an appreciation **for** things **of** beauty;
g. understand his physical environment.

The challenge is what type of mathematics do we teach and how do we teach it to enable our students realise these objectives? There is also another side to this.

It is an undeniable fact that one of the factors that contributes to high drop our rate is the poor, uninspiring teaching and more specifically the teaching of mathematics. It is important that before we address these issues we should look at where we have come from and the present state of mathematics education at the basic education level and especially at the primary school level which is the foundation stage.

In my first address as president of MAG, I gave some reasons which had contributed to poor teaching and learning of mathematics which had led to moves for change. Permit me here to quote only a few which I consider pertinent in our discussion.

Firstly, that mathematics was thought of as a collection of disjoint branches having no inner relation to each other. Secondly, mathematics had been reduced to a bag of tricks, to juggling with symbols and expressions according to rules which had to be memorized. Thirdly, the textbooks in use did not suit the environment and circumstances **of** most pupils. The language used was stiff and above the vocabulary of the pupils.

Changes were affected but we have not seen much improvement. Probably we did not heed enough the advice given by Professor Servais, when he stated, and I quote:

> "To modernise the contents of a programme does not suffice to improve, ipso facto, the product of the study of mathematics. The didactic methods must also undergo a favourable evolution. It is an illusion to believe that a dogmatic instruction of modern subjects will assure genuine assimilation It will only condition the intelligence in a servile and traumatic fashion".

What is the present state of mathematics at the basic educational level?

A study on the West African Examination Council (WAEC) Basic Education Certificate Examination by Eshun and Kpemlie in 1993, involving 474 pupils in the third year in Six Junior Secondary Schools (JSS) in the Cape Coast District revealed wide differences in mathematics achievement. Similar results were obtained by the investigators in a separate study using comparable tests. It was remarked that the six schools were selected out of 33 JSS in the district on the basis of their superior performance in the 1992 BECE results.

The poor performance in mathematics urged the Ministry in 1992 to institute a test, designated "*criterion-referenced test*" (CRT), to determine the extent of pupils' performance in the subject. Four content areas were assessed. The areas were basic number concepts, number operations, story problems, and geometry and measurement. The test, which comprised 100 items from the four content areas, took 140 minutes. A summary of the results of the CRT for 1993, 1995, and 1996 are presented in Tables I, II, III and IV. What do the figures in these tables tell us? What further conclusions can we draw from these results?

One can see from Table I that in 1993, in four of the regions less than 1% reached the criterion set and 3 regions reached 1% but less than 2%. In the remaining three regions, between 2.5% and 4.7 reached the criterion. The highest performance was observed in the Western Region, where 4.7% reached the criterion.

Table I Results of the Criterion Reference Test: 1993

Region	No. of Schools	No. of Pupils	Mean Score	No. Reaching Criterion	Per Cent Reaching Criterion
Ashanti	78	2289	26.1	12	0.5
Brong Ahafo	54	1292	26.6	5	0.4
Central	51	1165	27.2	11	0.9
Eastern	79	1652	25.1	16	1.0
Greater Accra	29	1178	30.9	29	2.5
Northern	34	616	27.8	10	1.6
Upper East	25	567	28.0	19	3.4
Upper West	21	510	26.6	3	0.6
Volta	56	1439	27.5	18	1.3
Western	47	1141	30.4	54	4.7

In 1996, as can be seen in Table II, there was a slight improvement. In six of the regions the percentage reaching the criterion was between 1% and 2%. But in no region did the percentage reach 4%. Out of a sample size of 12,752, only 224 representing 1.8 % reached the criterion set. That is, 141 boys and 83 girls, which constitute 2.0% and 1.5% respectively. The national mean score was 28.8 %.

mastery over the objectives tested. With regard to the main content areas, as can be seen in Table IV), only 6.1% reached the criterion set with respect to basic number concepts. In basic operations only 4.2%, and with respect to story problems and geometry, the situation was catastrophic.

Table II Results of the Criterion Reference Test: 1996

Region	No. of Schools	No. of Pupils	Mean Score	No. Reaching Criterion	Per Cent. Reaching Criterion
Ashanti	67	2136	28.8	28.8	1.2
Brong Ahafo	55	1140	27.7	27.7	1.3
Central	48	1227	27.5	27.5	1.0
Eastern	77	1717	28.2	28.2	1.0
Greater Accra	27	1315	30.6	30.6	2.9
Northern	39	957	27.0	27.0	1.1
Upper East	30	983	29.9	29.9	2.2
Upper West	23	397	28.1	28.1	1.0
Volta	61	1687	29.2	29.2	2.3
Western	50	1193	29.9	29.9	3.4

Majority of the pupils failed to reach the set criterion because they lacked simple manipulative skills. Table III shows the proportion of the samples used over the years who were able to demonstrate their

Table III Proportion Demonstrating Mastery of Objectives by Year

Objective (content)	Proportion Demonstrating Mastery		
	1992 (Base Line) (Sample size 11,488)	**1993** (sample size 11,849)	**1995** (Sample size 12,376)
1. Numbers on the number line	0.27	0.29	0.29
2. *Use of <and>*	0.22	0.23	0.24
3. Prime numbers	0.24	0.24	0.24
4. Prime factors	0.34	0.37	0.40
5. Rounding numbers	0.23	0.22	0.23
6. Meaning of fractions	0.26	026	0.26
7. Changing fractions to decimals	0.19	0.20	0.20
8. Changing decimals to fractions	0.20	0.21	0.21
9. Changing fractions to percentages	0.23	0.24	0.26
10. Dividing by 1-digit number horizontally	0.26	0.27	0.28
11. Adding simple fractions - different denominator	0.20	0.19	0.20
12. Adding mix fractions	0.23	0.23	0.23
13. Subtracting simple fractions – same denominator	0.27	0.27	0.28
14. Subtracting mixed fractions	0.21	0.22	0.22
15. Multiplying using mixed fractions	0.16	0.16	0.16
16. Dividing using mixed fractions	0.19	0.18	0.19
17. Finding highest common factors (HCF)	0.27	0.27	0.28
18. Subtracting decimals vertically	0.22	0.23	0.22
19. Dividing decimals by powers of 10	0.22	0.22	0.16
20. Finding least common multiple (LCM)	0.18	0.18	0.17
21. Expressing ratios in simplest form	0.17	0.17	0.18
22. Dividing quantities in given ratios	0.20	0.20	0.19
23. Expressing a quantity as a percentage	0.18	0.20	0.19
24. Percentage increase or decrease	0.18	0.18	0.17
25. Averages	0.20	0.19	0.19
26. Naming angles in a triangle	0.29	0.28	0.28
27. Area of a rectangle	0.25	0.24	0.23
28. Area of a plane region	0.21	0.20	0.20
29. Changing units of area	0.21	0.19	0.19
30. Folding symmetry	0.13	0.14	0.13

Mr. Chairman, these analyses presented reveal that mathematics performance at the primary level gives much cause for concern. There is no gainsaying that teaching of the subject is a contributing factor. What about the teachers who teach mathematics at this level. Primary Education Program (PREP) conducted a study on selected teacher trainees using the same set of CRT test items. The study revealed that some of the trainees teachers faulted in the very areas that

the pupils had performed poorly. Also, last year I was privileged to serve on a panel for selecting the National Best Teacher's award winners. The candidates who appeared before the Panel were those adjudged the best Regional award winners.

Table IV Performance 1996 CRT in Sub-test Areas of Content by Year

Region	Basic Number Concepts		Basic Operations		Story Problems		Geometry and Measurement	
	MS	PRC	MS	PRC	MS	PRC	MS	PRC
Ashanti	29.0	5.2	31.1	4.2	24.8	0.9	26.2	1.3
Brong Ahafo	28.0	4.3	30.2	3.5	24.3	1.3	25.4	0.4
Central	28.3	4.6	29.2	2.0	25.0	1.4	25.4	0.9
Eastern	29.3	5.0	30.0	2.7	25.2	1.9	25.6	0.9
Greater Accra	31.2	7.4	33.1	6.7	27.8	2.5	27.1	1.0
Northern	27.5	5.0	28.4	2.8	24.8	1.1	25.2	1.4
Upper East	30.7	8.7	32.3	5.0	26.5	2.5	26.8	1.5
Upper West	28.2	3.8	31.3	4.5	23.7	0.3	25.4	0.5
Volta	30.3	7.0	31.2	5.0	25.8	1.5	26.6	1.0
Western	30.5	8.9	31.3	5.4	27.6	4.1	28.0	3.5
National	**29.6**	**6.1**	**30.8**	**4.2**	**25.6**	**1.8**	**26.2**	**1.3**

One of the questions I asked at the primary level was 'How do you teach $\frac{1}{3}+\frac{1}{5}$ in primary four? Two of the ten award winners gave this method, 'Add the numerator and add the denominators'.

Teacher Training Colleges have a responsibility to support both pre-service and in-service education of teachers. Attempts to improve mathematics teaching and to lay solid mathematics foundation at the primary level should start at the Teacher Training level.

Here let me suggest an approach that could be followed. As a first step, the mathematics tutors should set before the students what the goals of mathematics instruction at the basic education level should b. Basically there are three. Firstly, the goal of mathematics teaching is that children learn to read mathematics, that is, to learn fundamental concepts that are basic to the understanding of the subject. They must learn to express these concepts in words and later in symbols. They must come to see relations among these concepts. It is the grasp of these fundamental ideas that will permit children to construct, each child for himself /herself the fundamental operational facts in arithmetic and spatial relationships in geometry. By this the child will be led to understand what mathematics is- why it work in the way it does – what each idea means.

Secondly, the child must be able to *do* mathematics. It is truism that unless a child learns to compute skillfully, with ease and unhurried calm, he/she will be handicapped and frequently frustrated throughout the rest of his/her life. Hence the second goal is that children be able to develop skill in handling mathematical symbols and concepts so as to obtain mature performance. These skills are indeed a tool, but a tool which must be thoroughly understood so as to free the mind of routine work and permit it to concentrate on new learning.

This leads to the third goal of mathematics teaching to develop the ability to solve problems. All new learning can be conceived of as problem-solving. A problem is a situation in which a desired outcome is sensed or known, but the intellectual means to the goal are unknown to the child. If concepts are well established by going from

physical situations to mathematics ideas and then back to physical situations, and if all new learning are directed discoveries of ideas and methods, then the third goal will be attained more easily and surely than it would be if the child had to learn by rote.

It is also agreed that one's teaching methods are influenced by how one was taught. In that case, tutors must as far as possible relate their mathematics to everyday life. As Sawyerr remarked.

> "The cause of the fear of mathematics does not lie in the nature of the subject itself. The most convincing proof of this is the fact that people in their everyday occupations - When they are making something – do as a matter of fact, reason along lines which are essentially the same as those used in mathematics, but they are unconscious of this fact, and would be appalled if anyone suggested that they should take a course in mathematics"

Trainee teachers need to e constantly reminded that early mathematics originated primarily as a practical science to assist in agricultural and engineering pursuits. That these pursuits required the computation of a unable calendar, the system for weights and measures to serve in the harvesting, storing and apportioning of food, the creation of surveying methods for canal and reservoir construction and for parceling land, and the evolution of financial and commercial practices for raising and collecting taxes and for purposes of trade.

I need not mention that the teacher trainees should be taught how to use activity method in their teaching.

The Association has a responsibility to intensify our membership drive to have more and more of Teacher Training tutors join the Association so that we can sensitise them with such ideas at our conference/workshops. The Association should also endearvour to attract basic education teachers to be members through regular in-service courses at the District and Regional levels. During my tenure of office as Chairman of the Mathematical Association of Ghana we initiated an action to get the Director-General to consider for promotion to the level of senior superintendent through a series of in-service courses. A syllabus for the courses was draw. There may be the need to go into the archives for it and update it. The Association can revive this move.

Th Chair, I am not unaware of the move to have special training for trainees to teach in the primary schools. But is the time propitious now to institute subject teaching in BS1-6 as is being done in BS 7-9 in key subject areas such as mathematics, science and English?

The Chair, allow me also to bring up another issue. The re-introduction of subject organisers in key subject area such as mathematics . Diplomates and Graduates in primary mathematics education could be drafted. This will assist in mounting meaningful courses for teachers at basic education level. No doubt this will make a definitive impact on mathematics teaching at the basic level and therefore help to achieve one of the objectives of the FCUBE – to improve the quality of teaching and learning.

There is another issues which I wish to throw up. What mathematical knowledge that is worthwhile for those students who would terminate formal education at BS9 and enter apprenticeship to learn some trade? The Ministry of Education and the Ghana Education Service would need advice on this.

In conclusion, let us as an Association, be in the forefront in sustaining interest in the subject. Let us assist in educating our future mathematicians for the increasingly technological age and particularly for the 21st century which we are about to enter.

Thank you.

Presidential Address: 6th National Biennial Delegates Conference at Denu

President's Acceptance Speech

[6th National Biennial Delegates Conference of the Mathematical Association of Ghana (MAG), at St.Paul's Secondary School, Denu, August 10 - 13, 1999]

Mr. Chairman,

Honourable Regional Minister,

District Director of Education,

MAG Executive,

Fellow Delegates,

Distinguished Guests,

Ladies and Gentlemen,

I am deeply honoured to address you as the President of this august association. I cannot believe it is 20 years since I ended my third yearly term as Chairman. I sincerely thank the MAG Council for my appointment and the confidence placed in me.

By the grace of God I hope to justify the trust reposed in me. My goal is to join the Council, to lead the association into the year 2000 which coincidentally will be our 40th Anniversary, two very significant landmarks. It is said life begins at 40 for a person, but what about an association? At 40 MAG has developed the structures of a strong and vibrant association to serve its members, the mathematics community in Ghana, students at all levels, parents and indeed the country as a whole.

MAG has one and only one vision and that is to improve the teaching and learning of mathematics in our schools and training colleges. To improve means the association shall never rest on its achievements but strive to explore new ideas to bring relevant and current innovations into mathematics classrooms in Ghana. I am proud to be associated and committed to such a vision. I would like to focus our attention on an aspect of our vision we have not tackled in the past.

The University of Cape Coast is producing on the average only four females per year with B.Sc. or B.Ed. in Mathematics. The situation is no different from the other universities. This means that our senior secondary schools and training colleges have hardly any female mathematics graduate teachers The implication is that MAG's goals have not been realised with respect to the mathematics education of the girl child. Our vision must include as a major issue the goals of achieving equal numbers of female and male mathematics graduates. This means the association has to strengthen its partnership with the Universities, Ministry of Education and the Ghana Education Service as well as the Government to improve the mathematics education of the girl child.

In addition as a professional association, we have the responsibility to provide the leadership that will be required to achieve the above vision. This is not an impossible vision because our collective success is linked with the scientific and industrial development of the country. For until the girl child receives the appropriate mathematics education, her participation in science and technology will be negligible, and Ghana will lose half its scientific and industrial manpower.

Dr. Benjamin A Eshum

Senior Lecturer in Mathematics Education,
University of Cape Coast

SEE NEXT PAGE FOR PRESIDENTIAL ADDRESS

Mathematics Education Today

[Presidential Address]
Dr. Benjamin A Eshun
Senior Lecturer in Mathematics Education, University of Cape Coast
[Paper delivered at the 6th National Biennial Delegates Conference of the Mathematical Association of Ghana (MAG), at St.Paul's Secondary School, Denu, August 10 - 13, 1999]

What is Mathematics Education Today?

I shall now focus my address on the question " What is Mathematics Education today?" I hope to point out some major innovations in mathematics education throughout the world. Traditional mathematics, which contained a major component of Euclidian Geometry, was replaced in many countries including Ghana in the 1960's and 1970's. This was for three main reasons:

i. Many students were failing Euclidean geometry. And it was found that the properties of geometric shapes could be studied more easily through the use of transformation geometry and symmetry that excluded proofs.

ii. It was found that new content like sets, relations functions statistics and probability could be conveniently studied as early as the primary schools.

iii. The discovery approach to teaching mathematics was considered more appropriate than exposition that leads to rote learning. Teaching for understanding was emphasized more than the drill and practice in traditional mathematics.

However, by the end of the 1970's it become evident that the New (or Modern) mathematics was throwing away 'the baby', that is, *proficiency in computational skills,* with 'the bath water', that is, *drill and practice*. In other words, by emphasizing understanding, students were no longer able to do mathematical computations quickly as well as recall basic facts and rules in the subject.

Thus in the 1980's, the *'Back-to Basics'* slogan used by a movement, which agitated for content that has the resemblance of traditional mathematics, began to eclipse the successes of the Modern mathematics. In the Mathematics Education communities, the Modern Mathematics was seen as a coup against traditional mathematics (Malady, 1988). But the regime and reign of the Modern mathematics was unsuccessful in leading students to master mathematics. The 'Back-to Basics' itself has turned out to be another coup because it is now evident that while neither Traditional nor Modern Mathematics could stand alone, each has something good to offer to Mathematics Education. So now instead of coups, we have reshuffled cabinet ministers, that is, innovations in every aspect of mathematics teaching and learning.

I shall discuss three such innovations due to the time at our disposal. Each innovation will require its own hour lecture or better still a week's long workshop for full understanding.

The current thinking in mathematics education is that:

- the teacher should no longer be a dispository of knowledge who therefore has to impart knowledge to the student.
- the teacher is now a facilitator of learning and therefore interacts with the student and knowledge comes directly from the student.

Thus the teacher has to engage the student actively in the classroom by requiring him/her to perform tasks. The activities must be more than merely applying acquired skills or procedures. The focus of current reforms is on

- Teaching for Understanding (TFU),
- employing alternative assessment, and
- the use of technology in mathematics.

Teaching for Understanding (TFU)

In the New Math era, that is, in the Joint Schools Project (JSP), mathematics learning with understanding meant being

able to explain a rule or relation used in solving a problem.

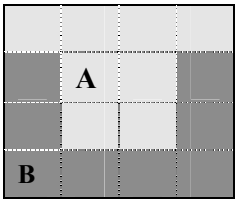

Fig. 1

For example, a student can reason logically to explain why both regions A and B in Fig. 1 have the same area. In the current teaching for understanding the student has to learn to demonstrate understanding of two equal regions by himself and in several ways.

We shall illustrate this later after I have explained the framework for TFU designed by a team of researchers, including Mathematics Educators and Psychologists at Harvard University.

In the TFU framework the teacher must do the following:

- comprehend the generative topic
- define understanding goals
- design understanding performance tasks/goals
- enact ongoing assessment (Wiske, 1998).

A generative topic is a broad topic or a unit (Chapter of a book) that generates mathematics ideas, concepts and skills in a connected manner. For example, a task defined under a generative topic may involve fractions, number operations, shapes, finding areas, (rectangles, triangles), symmetry, etc.

Students demonstration of understanding are assessed along four dimensions:

- knowledge – beliefs and coherent concepts
- methods – building and validating knowledge
- purposes – awareness of purposes and uses of knowledge
- forms – mastery performance and effective used of symbols (Hetland, et al., 1998).

For each of the dimensions there are four levels of understanding:

* naive(level 1) – uses intuitive knowledge sees task in simplistic terms.
* novice (level 2) – uses experience from schooling, rehearsed form of knowledge.
* apprentice (level 3) – uses mathematics mode of thinking, flexible in ideas.
* master (level 4) – performances are integrative, creative and critical.

For a teacher to practice TFU in the classroom, he/she needs to understand how to present ideas, answer students' questions and guide students' performances so that they successfully engage in performing their understandings. What this requires of a teacher is 'pedagogical content knowledge' and understanding of how students think about the subject matter to be understood, including the ways the student tend to misunderstand and forget it. An essential factor in applying TFU in the classroom is a teacher's capacity and inclination to listen carefully to students as they perform tasks and adjust the curriculum (content) in response to the students.

Performance Task 2

On a centimetre dotted paper, draw a square of area 16cm^2. Divide the region into two equal halves. Draw a separate diagram for each possible way you can divide the region. Justify each solution.

[Note that some students may draw a square of area 9cm^2 as they take a dot as a centimetre rather than the space between two dots.]

I shall now illustrate how students can demonstrate understanding along this dimension of knowledge.

Naive (Level 1) of Knowledge

The student at this level uses a single horizontal, vertical and diagonal line to create two identical regions by symmetry (see Fig. 2 on the cover).

Novice (Level 2) of Knowledge

The student uses a single straight line joining two opposite sides to create two identical regions by symmetry (see Fig. 3 on the cover).

Apprentice (Level 3) of Knowledge

The student connects line segments to create two identical regions still relying on symmetry (see Fig. 4 on the cover).

Mater (Level 4) of Knowledge

The student connects line segments to create two non-identical but equal regions each of 8cm^2. The student does not use symmetry but relies on counting squares of 1cm^2 and half squares of ½cm^2 (see Fig. 5 on the cover).

The above performance task will be under a Unit-Geometry. Here the generative topic, geometry may be defined as the study of lawfully connected patterns. The understanding goals are

- recognise lawfully connected patterns
- define and employ lawfully connected patterns
- reason logically by means of decomposition, rearrangement and connecting concepts.

I am sure the question on some peoples minds is what other tasks can be performed to achieve these same goals.

Here are some tasks to try yourselves and with your students.

Performance Tasks 1

1. On a centimetre dotted paper (or geoboard), draw or make triangles that have the following areas:

   i. ½cm^2. ii. 1cm^2. iii. 1½cm^2.

   iv. 2cm^2. v. 5cm^2. vi. 18cm^2.

   How many triangles can you draw or make for each area? Justify your solution.

2. On a centimetre dotted paper (or geoboard), draw or make squares of area from 1cm^2 to 20cm^2. Which areas are possible? Justify your solutions.

Assessment of Mathematics

With the stress on teaching for understanding and students required to demonstrate understanding, the question that comes to mind immediately is 'How does a teacher treat students under such a context and obtain grades for students?'

The first observation is that teaching and testing are very dependent on the way we conceptualize knowledge, and that knowledge can be acquired or learned. Secondly, teaching and testing are not two different aspects of a teacher's job but two integrated activities. Each activity informs and determines the other. Also, assessment with a wider meaning than testing is now widely used.

A test is itself a form of assessment. Further, assessment is an ongoing activity of the teacher just as teaching itself. Even the continuous assessment concept can fall short of the ongoing assessment if only homework, test, quizzes and projects are graded at fixed points during the instructional period. These forms of assessment are referred to as traditional assessment and it does not provide all the information a teacher needs to determine the ability of a student to do mathematics.

The National Council of Teachers of Mathematics defined assessment as the process of gathering evidence about a student's knowledge, ability and disposition toward mathematics and making inferences based on that evidence, for a variety of purposes (NCTM, 1989).

Traditional assessment was based on the view that the teacher is to transfer the 'given' knowledge into the heads of the students. There is now a new form of assessment called *authentic, performance* or *alternative* assessment. The various forms of this alternative assessment are observation, interview, class presentation, extended problem solving take-home test, journals, group work (activities and tests), portfolios and performance test. Alternative assessment is built on the psychology of Piaget and Vygotsky and emphasizes the construction of knowledge by the student. Thus it reflects beliefs both about what it means for students to demonstrate that they know mathematics and how the students come to know it.

The main goal of alternative assessment is to gather evidence about how students are approaching, processing and completing real life tasks in a particular domain (Gracia & Pearson, 1994). One feature of alternative assessment that is helpful to many students, especially those of low ability, is that through group work students get help to understand concepts. Also through journal writing and portfolio development students are made to reflect on their learning and how they do

mathematics. This enable the student to keep track of their thought processes and assess why they do or do not understand something and the nature of the help they need to acquire that knowledge (Eshun & Abledu, 1999).

A research, which used alternative assessment (interview, journal, group work and portfolio) in addition to traditional assessment to assess female students of a training college in the Cape Coast Municipality, supported the positive benefits of alternative assessment. Table 1 shows the mean scores of students in pretests and posttests of internal achievement test (based on the content of instruction) and the external achievement test (similar to the Senior Secondary School Certificate Examination (SSSCE) paper in mathematics.

Table 1 Mean Scores on Pretests and Posttest Achievement Measures

Group	Number in Group	Pretest	Posttest	t-value
Internal Achievement				
Control Group	41	4.4	7.4	7.3
Experimental Group	38	4.3	8.6	6.9
External Achievement				
Control Group	41	4.0	4.9	1.8
Experimental Group	38	3.0	5.0	3.4

The results in the table show that while the control group, which had only traditional assessment, improved significantly in only the internal test (Posttest over pretest), the experimental groups, which had both the traditional and alternative assessments, improved significantly in both the internal and external tests.

The findings indicate that the extra alternative assessment activities significantly increase the students ability to use problem solving approaches in new situations. This is because both groups of students were not taught many of the items on the external achievement test.

Technology in Mathematics

Calculators are now permitted in the SSSCE. But this is no real advancement if the introduction of the calculator does not influence the nature of mathematics taught in schools and the nature of problems for which the calculator is to be used. In the USA where the calculator is as important as a textbook, pupils in primary schools are solving problems that would have been impossible even in the New Mathematics era.

Mathematics is now regarded more as problem solving than learning to compute with numbers and identifying geometric shapes. Problems here refer to challenging questions without a routine procedure as solutions. For example, '23 + 18' is not a problem to a Primary Grade 2 child who can count to 100 and recall from memory that 8 + 3 is 11. But this is a problem to another child who can count objects only up to 50 correctly but has not memorize 8 + 3 and has never added numbers greater than 10. The latter child will always have to count objects before solving 23 + 18, if he/she recognizes that as a solution. The first child however, can be taught the procedure to solve 23 + 18 without counting on objects, but not the second child.

In another sense, 23 + 18 is not a problem to a kindergarten child who can barely count up to 5 objects and sometimes missing the order of the number words. This child is in the same position as Pope John Paul II for whom kicking penalty is not a problem, because by his age and health he has not got the interest nor the energy to accept the challenge. But to Abede Pele, kicking penalty is a problem, because there is no known way to kick the ball and always score a goal, despite one's skills in the game.

In problem solving, general strategies like

- drawing a diagram,
- formulating an equation,
- making a table,
- acting out the story,

can be taught and learned but every problem will present a challenge unless a similar problem has been solved before.

For example, placing the digits 1, 2, 3, ... gram in Fig. 6 such utive digits share a er will be a problem ss we have solved a

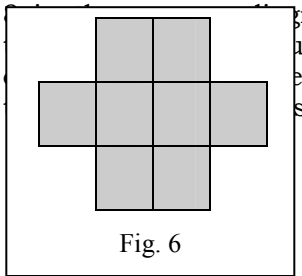

Fig. 6

similar one before. But this problem can be solved by children in Grade 2 and above.

The graphing calculator, which by its name can also draw graphs of functions as well as that of statistical data, has transformed the way algebra, statistics and other content areas of mathematics can be taught and learned. Consider, for example, the problem and the solution that follows:

Vacation Journey on Problem

The State transport Corporation (STC) has a special deal for a group of student traveling as an organized body to the same school or town after a vacation or at the beginning of a vacation respectively.

Each bus seats 60 passengers and the group must charter 3 buses. If the group fills the buses the price per ticket is ¢8,000. The price increases by ¢200 for each empty seat. If the STC charges the group ¢1,200,000 for the 3buses, what is the minimum number of students needed for the group to break even, that is be able to pay the minimum cost?

Solution

Let x represent the number of empty seats.

Number of students in the group is $180 - x$

Price per ticket is $¢(8{,}000 + 200x)$

Equation to be solved is $(180 - x)(8{,}000 + 200x) = 1{,}200{,}000$.

Students with no knowledge of quadratic formula can easily solve the equation with a graphing calculator (Barret & Goebel, 1990). This does not mean no mathematics will be learned. Writing the equation is itself a challenge, even to the student who can integrate algebraic functions because the question is unfamiliar.

To solve the equation we need to graph the functions

$$f(x) = (180 - x)(8{,}000 + 200x), \text{ and}$$
$$g(x) = 1{,}200{,}000,$$

on the same axes or simultaneously on the graphing calculator and determine the point of intersection. The problem for the student is to determine the appropriate interval and specify the viewing window for the graphs. No pencil and paper is needed. By trial and error this can be done using the graphing calculator.

Next the student has to know that x (*empty seats*) must be less than 180. Taking an interval (-50,200) for x and (-500,000, 3,000,000) for y gives the full graph. (Use the ZOOM OUT and TRACE to figure out the intervals for x and y).

Using the cursor, we can see the solution is between 145 and 155 empty seats.

Using ZOOM IN (graph gets enlarged and is focused around the cursor) and ZOOM OUT (graph gets reduced and gives fuller picture) to locate the solution as 148 empty seats.

Of course if bus is full then the group will make ¢1,440,000 with a profit of ¢240,000. When the profit is shared each student gets back ¢1,333. But 148 empty seats means the remaining 32 students will pay ¢(8,000 + 200 * 148) = ¢37,600 or ¢29,600 more.

The problem can be varied to answer several questions.,

i. How many empty seats, if extra price is only ¢100, ¢50 or ¢1?

ii. How many empty seats, if initial price was ¢6000, ¢5000 or ¢3000?

iii. At what price per ticket would the group have to fill the bus or lose money.

Conclusion:

Mathematics teaching has taken a new and very exciting turn for both the teacher and the student. The teacher can now teach relevant and real life mathematics as well as all the higher concepts and skills required to do mathematics. The teacher can also assess the student in any manner that will permit the student to show real understanding of mathematics. Thus the teacher is no longer driven by external examination requirement because his/her students will be well prepared to cope with the external demands. The power of problem solving skills and the power of technology will be the students' advantage.

Have we now reached the utopia for mathematics teaching and learning? We have come a long way but have still some distance to go. Man is an intelligent being with the capability to transform his/her environment. A look at the advances in information technology where the Internet is making the telephone companies think again, shows the extent of man's capability. They are providing the services

for the Internet but man can now talk over the computer to someone thousands of miles away at virtually no additional cost.

This is mathematics today.

How does this inform you to reform your teaching?

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NEW MATHEMATICS BOOKS FOR SENIOR SECONDARY SCHOOLS

Frank Segbawu,
SEDCO – Representative of Longman

PAPER PRESENTED AT THE 26TH NATIONAL GENERAL WORKSHOP/CONFERENCE OF THE MATHEMATICAL ASSOCIATION OF GHANA (MAG), AUGUST 24 - 29, 1998, AT ST. JAMES' SEMINARY/SECONDARY SCHOOL, SUNYANI

Mr Chairman, Hon Regional Minister, Distinguished Guest, Fellow MAG members. Let me congratulate you and your association for your foresight and hard work in getting ready this SSS mathematics series. I am honoured to be here at the promotion of the books and SEDCO and Addison Wesley.

Longman is honoured and proud to be the publishers of such an excellent series of books.

Four or five years ago we sent round a questionnaire to various schools nationwide asking you opinions about he strength and weaknesses of the famous JSP series and of the current (than new) GES titles now in the schools. Your enthusiastic responses and advice is what has guided us to produce our new series. And today were are here to celebrate the achievement.

The series has a lot to offer. It combines all the strengths of the old JSP and the current books in the system. It contains none of the former anomalies. It covers all the topics of the new syllabus and hence making teaching easier. Printed in top quality, the book is an

asset that will last. Each book can therefore be used by more than one batch of students thus making it cheaper for parents and guardians.

It will provide and become the largest and most reliable source of income for the association. Since this income will be in the form of overseas earnings it will enable the association to become financially stable and independent. The Association will then be able to put into effect all its plans, projects and other welfare schemes to the benefit of its members and the teaching of mathematics, in general. All these will be of benefit to you, fellow MAG members.

It is therefore your personal responsibility to ensure that the series takes off. The best and only way to do this is to ensure that every student and every school use to books. The first focus is your own school. If your own school is not using the books then you have not contributed enough. The second focus is the other schools in your district/region. Make sure that all the other schools in your neighbourhood adopt these excellence of yours.

Currently the Central Region has made a very good start with over 3000 copies of Book 1 already in use. They are closely followed by Western Region with over 1500 copies of Book 1 purchased by schools and Northern Region has about 800 copies in use. To members in the other Regions, I say the ball is now in your court.

Some of the factors that will work against the success of the series include

- apathy
- competing books and
- unapproved distributions.

Mr, Chairman, My dear MAG members, let us not allow apathy to deprive us of the huge benefits which we can enjoy for a long time from our own labours. Like the JSP these books will become a symbol of the association and as such a barometer of the health progress and prosperity of MAC. Let us go out therefore with an evangelical to promote and zeal and enthusiasm and establish the cook.

Over competing books are not too much a problem because you have produced a book of high quality. The problem however is in the temptation for some heads of department or schools to go in for the cheaper takes which although cost lessen do not impart the same learning experience to the students. Therefore let us ensure that these other books do no interfere with the nationwide adoption by all schools.

We have to help stop unapproved or unlicensed distributors. One problem that is already emerging is the scramble by some suppliers/middlemen to take advantage of your had work to make some money. Some of them have gone to the schools to collect orders which thy have of course been unable to supply. This is creating the impression that the books are not available.

There is no need to pass through these agents. Place all your orders direct to SEDCO who are the official representatives of your publishers. We have all the stock you need and the price is low. All those who have placed orders worth the agents should forward the requests to us for immediate transaction. We also offer the schools who make bulk purchase a 60-day credit period to allow the accounts Dept to collect the money from students before paying to reduce the financial pressure.

The Chair, distinguished Visitors, I again congratulate you for this work well done. But there is still another hurdle to take. That is the Primary/JSS series. I hope you will use this conference to plant the seed and hope to reap the fruit at your next general conference/workshop. Together we can make it. Let us ensure the success of the series and that, this project is the first of many generating book sales by the association all in effort to improving the teaching of mathematics.

Thank you.

MAG Begins a New Textbook Writing Project with SEDCO

At an executive meeting held on August 24, 1998, at Sunyani, it was agreed that the association undertakes a book writing project with SEDCO. The project is to write new mathematics textbooks for primary and junior secondary schools based on the reviewed syllabuses. The project began in October 1998, and a number of writing workshops have since been organised.

School Mathematics in Ghana: 1960 - 2000

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[Paper delivered at the 6th National Biennial Delegates Conference of the Mathematical Association of Ghana (MAG), at St.Paul's Secondary School, Denu, 10th – 13th August 13, 1999]

Abstract

The official school mathematics curriculum - textbooks, teacher's handbooks, and syllabus - has a powerful influence on classroom practice in a developing country like Ghana, where many teachers with low teaching qualifications hardly ever have access to other sources of information and activity for their teaching. The current official mathematics curricula materials for Ghanaian basic schools (the Ghana Mathematics Series) were originally written with the small intellectual elite, who will proceed to secondary and further education, in mind. This presentation examines

- why concerns were raised internationally for countries still using the 'new math' textbook schemes to adjust them;
- the effects of curriculum development projects in the mathematics and educational reforms on the Ghanaian school mathematics curriculum;
- how the Ghanaian official school mathematics curriculum is being reviewed to meet the challenges of the new millennium.

Introduction

Mathematics is one of the important subjects within the list of foundation subjects that constitute the core curriculum for basic (i.e. primary and secondary) education in countries throughout the world. The subject occupies a privileged position in the school curriculum because the ability to cope with more of it improves ones chances of social advancement (Mereku, 1992). It attained this position since it was made to replace classical languages like Latin or Greek which prior to the early half of this century were used as screening devices for entry to higher education and certain professions. As advances in computer technology have increased the usefulness of the subject and will continue to do so in the new millennium, there is the need to understand how these advances have revolutionised the content of, and emphasis in, school mathematics.

Currently, the mathematics syllabus for basic schools is under review to reflect the changing views about the subject and what is valued globally in it. In this paper, a historical background to the development of mathematics curriculum materials in Ghana is presented. The presentation is to enable mathematicians and teachers of mathematics to understand and appreciate the mathematical content and processes emphasised by the 'new' basic mathematics syllabus which will be used in our basic schools in the new millennium.

Developments in School Mathematics

The Canonical Mathematics Curriculum

The view that 'mathematics is a language, and provides a means of communicating information because it makes use of symbolic notation which is similar across continents, abstract ideas and concepts' has made many people to see the subject as universal. It was therefore very common in history to see countries using texts and syllabuses developed in other countries that were more developed, at least, in terms of mathematics. In tracing this history, Howson (1978: 133) briefly recounted that

> In medieval times the teaching of mathematics in England depended very much on written works of the Roman Boethius and the Greek Euclid. Later England and France exported text, such as Dilworth's Arithemetic and Legendre's Geometry to the developing United States of America. In the early parts of this century, the school children of the Empire (now Commonwealth) learned their mathematics from Hall and Knight, Godfrey and Siddon and later Durell.

It is not surprising that Ghana, the first African country to break away from the British Empire has preserved several of its educational traditions and for a long time, continued to use, in mathematics, curricula which were very similar to those developed for pupils in Europe and America.

At an International Mathematics Seminar in Kuwait in 1986, it was pointed out that

> the 'Western' curriculum, which was designed in a particular historical and cultural context for a few, has not only been forced upon all in recent years but also exported to other countries across the world (Howson and Wilson, 1986:8).

An international mathematics study in twenty developing and developed countries indicated that topics taught at the lower secondary level or to students between the ages of 12 and 15 years are similar to those taught at the same level in England (Travers and Westbury, 1989). In a similar analysis, Mereku (1990) found that the mathematics topics taught in the lower secondary level in three West African countries - Ghana, Nigeria and Sierra Leone - were similar to those taught at the same level in England. These are indications that curricula designed in a particular historical and cultural context were imported and not properly adapted. These observations support the fact that the school mathematics curriculum inadvertently acquired a universal status which unfortunately led many countries across the world to view it as canonical.

New Math

The changes in curriculum that resulted in re-naming the subject 'new-math' in America and 'modern mathematics' on the our side of the Atlantic, came as a result of a campaign for changes in the content of school mathematics. These changes were to allow the use of an approach to mathematics that will enable children to learn basic language and structure of mathematics as soon as possible. The major aim of new math was to link school mathematics with university (or higher) mathematics. The emergence of modern mathematics saw significant changes in the selection and the mathematical treatment of content at all levels of pre - university education in Ghana in the late 1960s and the early 1970s.

According to Howson, Keitel, and Kilpatrick, (1981), the need to bring the content of school mathematics more in line with university mathematics became necessary because the century preceding World War II saw the discovery of more mathematics than ever existed in the history of man. Several new results were reached in mathematics and announced. New methods and techniques for solving both old and new problems were developed and new concepts were created.

As early as 1967 the West African Examination Council had begun to set school certificate examinations on the work of the new math. And by 1971 the Primary School Mathematics Syllabus had been revised and completely transformed into a modern mathematics syllabus and was ready to be sent out to all schools (Ghana Ministry of Education, 1972, p. 69). Traditional arithmetic was taught in the primary school side by side with such new topics as logic and sets, measurement, shape and space and statistics and probability. Though we no longer talk about 'modern' or 'traditional' but just mathematics, sets run through all school mathematics. Number is seen as a property of a set, and teachers are strongly advised that the language, concept, pictorial representations and practical experiences of sets should be their starting points and should run through the mathematics they teach.

Mathematics Textbooks Development Projects

The new math led to major curriculum projects across continents between the 1950s and 1970s. This period saw many African countries obtaining their independence. The desire to improve education to meet the developmental needs of the new nations therefore created the ready desire for change before the new math curriculum innovations reached the continent (Hawes, 1979). This desire led

to the emergence of curriculum development committees or projects and the organisation of several conferences. Two main curriculum projects were involved in carrying out the new math innovation in Ghana. The first, which was inaugurated in Africa as early as 1961, was the African Mathematics Programme (AMP). The second was the Joint Schools Project (JSP).

African Mathematics Programme (AMP).

The AMP spearheaded the major curriculum changes in Africa. The AMP pursued a policy of bringing together African, American and British educators in English speaking African countries to influence mathematics education in Africa. To achieve its objectives, it organised writing workshops in Africa which produced several mathematics textbook schemes (Lockard, 1968). As a result the AMP developed the Entebbe Math Series (Commonwealth Secretariat, 1969, p. 156). These included materials for modern mathematics texts for primary, secondary and teacher training. Personnel were trained in editing and evaluation. The AMP schemes were tested in a small number of experimental schools mainly in the urban areas of the participating African countries. But the full implementation of the schemes was delayed for over a decade.

In the 1970s, two regional programmes were established to modify the AMP mathematics schemes for all institutions in the countries participating in the programme (William, 1976). One was the West African Regional Mathematics Programme (WARMP), which adapted the AMP mathematics schemes for primary, secondary, and teacher training, to the requirements of three participating countries: Ghana, Liberia and Sierra Leone. The other was the East African Regional Mathematics Programme (EARMP), which adapted the AMP mathematics schemes for the participating countries in East Africa.

The mathematics schemes currently being used in Ghana, the *Ghana Mathematics Series* (GMS) textbooks and Teacher's Handbooks (CRDD, 1986a, 1986b), were products of the WARMP. The series for primary schools were first published between 1975 and 1977 by the Ghana Ministry of Education. Those for junior secondary schools could not be published until 1988 when funding was obtained as a result of the Educational Reform Programme.

The Joint Schools Project (JSP).

Around the same period as the GMS schemes were being written, an initiative had began to design new schemes for secondary schools. This was the Joint Schools Project (JSP). The project was originated by Dr. E. M. Hartley (University of Ghana), Miss M. W. L. Harbourn and Mr. B. Raynor (both of Achimota School), and Mr M. C. Mitchelmore (Mfantsipim School). The project was aimed at "producing *new mathematics* course for secondary schools in West Africa, up to school certificate level" (Lockard, 1968). It was funded by three UK agencies - The Nuffield foundation, London; the Centre for Educational Development Overseas, London; and Overseas Development Administration, London. Associated agencies which also provided support for the project include the Mathematical Association of Ghana (MAG); University of Ghana; and the Ghana Ministry of Education.

The Joint Schools Project (JSP) team began the project working as a sub-committee of the MAG, and became self-directing in April 1965 with the appointment of an Executive Committee. In June 1971, when the majority of the experimental work has been completed, the Executive Committee was dissolved. The responsibility for completing and reviewing the JSP books became that of the editors and MAG. This has been done thrice since the books were first published in 1970.

The third review in collaboration with SEDCO Publishers to meet the mathematical needs of the changed structure of secondary education is yet to be completed. This last review was to abridge the 5-year series to a 3-year series for the senior secondary system. Book 1 is already on sale in bookshops all over the country and the publishers expect to get the other two books (i.e. books 2 and 3) ready before the 1999/2000 academic year begins in September.

The project originally produced textbooks in mathematics for Secondary Schools Forms 1 - 5, or age 11- 18. It was designed to meet the needs *of "all ability levels commonly found in secondary schools (approximately, top 15% of ability range)"* (Lockard, *op cit*).

The curriculum projects largely affected the development of school curriculum also in Ghana.

Differences between the JSP and AMP Curriculum Materials

It is necessary to point out here that even though the two curriculum projects were involved in development of mathematics materials, the products of African Mathematics Project which was largely American initiative differed in several ways from those of the Joint School Project which was British initiative. In the former the content and treatment of topics in primary mathematics was changed completely. Below is how Perreley (1988), an expert in mathematics education, described the changes.

> "In the primary schools set theory and the operations on sets were considered before the natural number itself. The mathematical operations were built on corresponding operations between sets. Geometry appeared from the beginning based first on the concept of topological transformation, and later as a projective and metric transformation. The algebraic structures became the framework for both arithmetic and geometry.
>
> In the secondary school, the same subjects were developed with greater rigour. In particular, by introducing the vectorial plane, the whole geometric structure was rebuilt, even using algebraic terminology. In a parallel way, there were early introductions to probability and to statistics, subjects completely new to pre-university education, and even to the university curriculum for future teachers of mathematics" (Perreley, 1988:872).

The changes that came with the JSP schemes were not so marked as those described above. The work of the JSP team was targeted mainly for secondary level mathematics, and did not presume the content would change so much at the primary level. Hence the change in content and approach to mathematics was not as drastic as what we saw in the AMP projects.

We therefore had a situation where the major mathematics schemes used in our basic and secondary schools lacked continuity since they came from two different projects. That is, the Ghana Mathematics Series (GMS) for basic schools and the Joint School Project (JSP) books for secondary schools were not compatible. The two projects were developed on different philosophies, their contents and style of presentation completely different. It was therefore not a surprise that most Ghanaian students experienced difficulty in switching to the JSP at the secondary level after using the GMS schemes in basic schools.

The Changed Structure of Education in Ghana

As a result of the reforms in education which began in 1987, the '6-3-3' structure of pre-university education has replaced the '6-4-5-2' structure, and thus, reducing the age at which the majority of students write their matriculation (i.e. university qualifying) examination from 23 years to 18 years. The first part of secondary education [i.e. junior secondary school (JSS)] is now comprehensive. That is, education at JSS level is now accessible to the majority, or as many children of school-going age as possible. The introduction of JSS resulted in the shortening of the period of pre-university education from a possible of 17 to 12 years.

Notwithstanding the changes in the educational structure, the scope as well as complexity of the content of the curricula for both senior and junior secondary schools were raised over and above what existed in GCE O'level, and Middle School Leaving Certificate level, respectively. Besides, all pupils in secondary education (both JSS and SSS) are made to follow similar syllabuses in the heavily loaded curriculum. As it is now very clear, only a few of the students are really capable of understanding the content prescribed by these syllabuses.

Influence of the Educational Developments on School Mathematics

The above developments have contributed in several ways to the decline in student performance in the subject. The development of the canonical school curriculum for mathematics inhibits any

form of curriculum development that will be planned in the subject in a developing country, especially in Ghana, where the curriculum is meant for a mass educational system. Thus teaching to all the mathematics which is aimed at the preparation of those who would go to study further mathematics at the university is inimical to the realisation of the national goals of education. To the majority of pupils, the canonical mathematics syllabus can offer very little opportunity to learn the basic mathematics concepts and skills that will be required to understand the environment, function properly in it and contribute positively to its development.

In the current basic school mathematics syllabus, there is still the presence of topics which emphasise the structural and deductive aspects of mathematics (i. e. sets-theoretical approach; algebraic expressions; axiomatic approaches). These indicate that Ghana has not yet joined the retreat from positions taken up in the 1960s in curriculum development in the subject. The school mathematics curriculum is still 'modern' (or new) math, that is, it emphasises the preparation of students who will do mathematics in further education or university.

At the JSS level, the mathematics syllabus is compartmentalised into Years I, II and III. Its design however, does not follow the spiral method, that is, the sequence of topics is not the same every year. Most topics which involve actual operations on numbers, fractions and measures occur in Year I; and with the exception of ratio and proportion and some applications of percentages, the topics for Year II and Year III are those that require some level of abstraction. Most of these topics which found their way into school mathematics as a result of the new math are in fact not relevant to the needs of the majority of JSS pupils who will not do higher mathematics after Basic Education. Among these are topics like quadratic equations, simultaneous equations, and logarithms.

In the mathematics syllabus and textbooks, the 'new math topics' have been broken into more units, and the notes on them cover more pages than the notes on the basic arithmetic topics. Since this reinforces the view of many mathematics teachers who think the modern mathematics came to replace the 'old', they continue to devote more time to the treatment of topics such as sets, operations on sets, numeration systems, integers and rational numbers. Very little attention is given to those that involve basic number operations and real life applications. There is nothing on calculators even though the devices are now increasingly being used by people in commerce and industry.

Although the spread of modern mathematics was largely due to both the new approaches to learning developed by psychologists and new content areas introduced into mathematics, these approaches were not as easy to adopt as the additional content or topics. A curriculum analysis study conducted by Mereku (1995) revealed that though there was rhetoric in the introduction of the curriculum materials on the use of teaching skills that suggest discovery methods, the learning/teaching activities that would encourage the use of such teaching skills in the materials were not included. The teachers were themselves not aware of the underlying structures of the approaches. Therefore in the JSS, many teachers are very likely to find it difficult to cope with the teaching of some of the modern mathematics topics that occur in the syllabus for years II and III. So several of them are likely to skip some of the topics.

The influence of the above developments on the school mathematics curriculum has been tremendous. A study commissioned by the ministry of education in the early part of this decade revealed that achievement of public schools is low in spite of in-service courses organised for teachers to improve the teaching and learning processes in schools, and in spite of the injection of inputs into schools. The study also indicated that mathematics teaching in basic schools focuses on computation skills, learning of formulas, rote practice and teaching as telling. The principal investigator in this study, Kraft (1994) argued that

> "the current syllabi, textbooks and teachers' handbooks do not meet the highest international standards, nor the current best thinking on sequence, learning and pedagogy and will not

prepare Ghanaian students for the needs of the next century" (Kraft 1994: 2).

This has been the nature of school mathematics curriculum that students entering secondary education in Ghana have received. The implication here is that by the time the majority of pupils begin secondary education their foundation in basic school mathematics is woefully low.

Implications for School Mathematics in the New Millennium

The limitations discussed above point to the fact that the basic mathematics curriculum that has remained in our schools for nearly three decades has little to offer the majority of pupils, thus those who will not continue to learn mathematics after junior secondary. Although the pupils will have experienced the kind of mathematics that only few had access to in the traditional secondary system, most of them at the end of the JSS will not be numerate. They will have very little opportunity to learn the basic mathematical concepts and skills that will help them to understand their environment, functions properly in it and contribute towards its development.

To overcome the inefficiencies in the curriculum, the current syllabus review panel's work was influenced by certain principles. The final part of this presentation will therefore relate some of the principles that underpinned what has been included in the new JSS syllabus.

To meet students' mathematical needs in the next millennium requires that the syllabus is designed in such a way as will enable all pupils to have the opportunity to study a style of mathematics appropriate to them as individuals. The content should be such that it can be developed sufficiently so that they can be applied in ways which the students can understand. There is no value in devoting a substantial proportion of the syllabus to teaching topics involving formal set theory, algebraic structures, number systems, logarithms, to mention only a few, to all pupils. This is because not all of them have the knowledge to be able to appreciate the contexts within which the topics are of use.

The new math was an attempt to link school mathematics to university or further mathematics. But today, there is a shift in emphasis in the curriculum all over the world. School mathematics is now being linked with everyday life mathematics. The content has been re-organised to emphasise mathematical processes (i.e. what mathematicians really do). Some of these are mental computations, practical measurement, estimation, approximations, building numerical and spatial patterns, real life applications, problem solving, investigations, and the use of such technologies as calculators and computers. Finally, the syllabus emphasises teaching activities that will enable the full development of students' verbal and mental abilities in mathematics so as to ensure their quick recall of basic number facts.

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Mathematics At The Threshold of the New Millenium: Problems, Prospects And Solutions

[Speech Delivered by **Mr. D. M. K. DOTSE**, *Ag. Headmaster, Three-Town Secondary School, Denu*, at the 6th National Delegates Workshop/Conference of the Mathematical Association of Ghana (MAG) from August 24th to 29th 1999, at St. Paul's Secondary School, Denu]

Mr. Chairman,

National Officers of the Mathematical Association of Ghana,

Other participant's at the 6th National Delegates Conference of the Association,

Distinguished Ladies and Gentlemen,

I wish to express my sincere gratitude to the organisers of the conference for their decision to make me part of the Conference.

In fact, when I first received the invitation, I was a bit apprehensive about accepting it because I have been less active in teaching the subject for a few years. Administratively however, I have been in touch with Mathematics teaching just as I have been with other subjects. What finally moved me into accepting to participate in the Conference is my desire to share some thoughts and experiences with you, with the hop that in my own small way I can help launch Mathematics properly into the 3rd Millenium.

My main focus is to try assess the situation and the fate of Mathematics in the basic schools and the impact of the situation of the subject in the Senior Secondary School after which some suggestions are offered in dealing with the problem so targeted.

What is the position of educational administrators about mathematics in schools?

I wish to propose that the teaching and learning of Mathematics is experiencing a lot of problem and that the expectations and aspirations of the people are not being fully met.

What then is the position of educational policy makers about Mathematics?

Basically speaking one can say with some degree of certainty that mathematics enjoys a lot of recognition and respect from policy makers judging from the policies that are being pursued. The following represent some f the positive policy decisions:

i. of all the in-service courses organised for teachers in the recent past, mathematics featured prominently.

ii. for students entering the Senior Secondary Schools, mathematics is a basic requirement. This can be seen from the programme requirements for such areas as General Science, Business and Agricultural Science as well as Technical Programmes.

iii. in the Senior Secondary school Mathematics, from the very on –set of the Education Reforms, is one of the subjects all the students are expected to study. It however shares such a prominent position especially with English Language and Integrated Science.

iv for entry into training colleges and other Post Secondary institutions, including the Universities and Polytechnics, a good performance in Mathematics is some of the important prerequisites. Here again Mathematics shares such a position with English Language.

v education for girls is high on the agenda of the Ghana Education Service. In the last few year attention has been focussed on Science, Technology and Mathematics Education (STM) for girls where the interest of girls in Science related subjects is being aroused, Mathematics features quite prominently.

In short therefore, it is quite obvious that educational administration do recognise the over-riding importance of mathematics in this country and have consequently designed policies to support that line of thought.

What is the reality on the ground?

Despite the official recognition of the status of Mathematics one cannot claim with a good degree of certainty that all is well. There are a lot of indicators that there are problems on the ground which must engage the attention of serious minded people who want to see progress in our educational set-up and more especially the way Mathematics is being nurtured,

The following points of focus speak about the foregoing assertion.

i. During last years base line survey which aimed at assessing the performance level in Mathematics and English Language throughout the country, it was quite clear that all was not well. In the Ketu District for example, the primary school with the highest performance level recorded 55.3% while the least level was 0.8%. What is quite disturbing about the Ketu case was that out of the 164 schools which were involved in the survey, only eight attained 40% or more. The situation in the Junior Secondary schools was no better than the Primary level. If the above analyses are anything to go by then it becomes clear that the mathematical background of those entering the Senior Secondary Schools is quite weak.

I wish to add that the problem of poor mathematical background of those entering Secondary Schools is not evenly distributed. Obviously the less endowed and the less popular schools suffer the more because they hardly enjoy patronage from quality students.

ii. Sadly enough the blame for the poor state of mathematics in the schools (Primary, Junior Secondary and Senior Secondary) are placed at the doorsteps of the teachers who handle the subject for the following reasons:

(a) From the type of mathematics tuition some of these teachers received they have developed the notion that the subject is so difficult that only gifted students can cope with it. This idea is either directly or indirectly transferred to their students who think that they are not among the so-called few and gifted ones who could manage the subject with ease.

(b) At all levels of pre university education some teachers skip over topics they consider to be stubborn or difficult. A study of the Chief Examiner's Report from the West African Examination Council confirms this.

(c) Sometimes too some teachers teach the wrong the wrong concepts in some topics. E.g., when teaching place value under a non-decimal base, like base three, some teachers caption the place values as 'Units', 'Tens' and 'Hundreds', etc., even though these are decimal labels.

(d) The extent to which teachers use instructional aids and games is on the decline. Yet these are the very things that can make learning interesting, painless and spontaneous. Sadly enough some people fail to use aids because they have no time or because they are not artists.

(e) The use of rote learning also creates understanding problems for the students. What happen here is that such teachers either commit procedures into memory and just pour them in class or they copy the procedure on the board for their students. By so doing such teachers leave no room for creativity and alternative methods for their students. Students' questions are therefore treated as being antagonistic or challenging.

iii. Resignation of students to fate: Since the students have not got the right spirit for mathematics they tend to brand the subject in various forms and hence decide not to make any further effort at all in learning it. One such terminology used by some students is '*the three devils'* that cover Mathematics, English and Science. Of course the use of devil the subjects is not to suggest that one could fall into problems when studying them but rather that the subjects are not manageable. May be the use of '*slippery angel'* would have been a better replacement.

iv. Matters actually come to a head in the Senior Secondary Schools where teachers instead of building on what the student learnt from the basic schools rather have to teach basic school lessons. By so doing, so much time is spent trying to bring the students to an appreciable level of understanding and lot of Secondary School work is left undone by the time the course is over. The obvious outcome of such a situation can be anybody's guess.

v. Staff inadequacy is another problem facing effective teaching in school especially the senior secondary schools. It is interesting to note that there are some schools without even a qualified Mathematics teacher. It should therefore come as no surprise when at the final examination very low results are recorded in such schools.

vi. The textbook situation in mathematics in basic schools is not helping matters in any way. In the Ketu District for instance, many students do not have access to them.

At this point, Mr. Chairman, Distinguished Ladies and Gentlemen, I wish to clarify the point that the foregoing points made are not meant to create the impression that everybody who is associated with the teaching of Mathematics is not helping the course of the subject in any way. On the contrary, there are very devoted and committed teachers in the system, both in the basic and secondary schools. All that is being said is to show that there is much room for improvement and that improvement should come urgently.

In the coming millenium, the subject is surely going to maintain its leadership position among the subjects, it will continue to be the pre requisite for going through various courses. It is precisely for these reasons that certain measures would have to be put in place in order to get things moving in the desirable direction.

What is the Way Forward for Mathematics in the Next Millenium?

1. Formation of District Branches of the Association

For the purpose of getting Mathematics to meet the needs and aspirations of the new millenium a lot has to be done and the Mathematics Association must be seen to be leading the crusade. One way of doing this is to encourage the formation of District Branches of the Association

throughout the country. Such branches should embrace teachers in the Basic schools too. For now, it appears the Association's activities and membership are limited to second cycle institutions. I am not sure how many delegates here have come from the basic schools.

The type of District branches being advocated are those that devote much of their time to the discussion of problem solving techniques. Difficult or stubborn topics should be collated from schools and through the assistance of Mathematics teachers from the Senior Secondary School and Training Colleges, such problematic topics should be dealt with.

I want to mention here that the exclusion for the District Directorates in the provision of the resource personnel if not to underestimate their role in service training programme but, because the districts, for now appear not to have the requisite personnel to handle such problems. It should be possible to think seriously about keeping at least one such staff at the offices.

There should be a similar arrangement for Senior Secondary school also. In this case however, the collated difficult topics could be assigned to those of their membership who can manage the topic to deal with. Training Colleges' staff, as well as personnel from other levels of education, could be drafted to assist at this level.

It is important to note that the type of arrangement suggested above should be done on a sustainable basic.

One obvious issue that would arise in connection with the above programme is funding. For this aspect to be taken care of, support should be given by the following:

(a) District Assemblies. Here I am not thinking of reliance on the District Assembly Common fund which appears to be overstressed in many areas but rather on District Education Endowment funds which are generated from within the Districts. Everybody who benefits directly or indirectly from education should be made to contribute to the fund on the basis of ability.

(b) The Ghana Education Service should commit more resources to the in-service training of teachers.

(c) Other stakeholders in education should also lend their support to the programme. I have in mind teachers' organisations like GNAT, CHASS.

(d) Non-governmental organisations could also be appealed to for support.

(e) Mathematics Association of Ghana membership contributions could also be used.

(f) Setting up to Model schools from the look of things a lot of teachers think some of the things they are to do to make teaching effective are unrealistic, given the problems on the ground.

Where model school are set up and performing teachers are used to staff such schools, the latter would serve as the "Mecca" to which teachers would visit in order to see the handling of all categories of problems on the ground. For convenience sake and for easy accessibility each circuit should have one such model school.

2. **Increased frequency of Ghana Education Service Organized Refresher Courses**

This arrangement should be regular. From the look of things, the G.E.S Organised Refresher Courses for teachers is rather irregular. Where the courses are irregular the impact on the teachers is such that they can easily relapse into their old ways of doing things.

Another problem, with the in-service courses organised for the teachers, is the absence of Follow Ups. It looks like much reliance is put on the circuit supervisors to do the follow- up. This does appear to be a good enough arrangement. Whiles the general supervisory role of circuit supervisors cannot be challenged where specialised and distressed areas are concerned such people may have their own handicaps. It should therefore be possible to get those who actually handled the courses to be involved in the follow up. Actually, such an arrangement would enable the course tutors or resource personnel to help deal with problems and difficulties experienced by the teachers during implementation.

What is being advocated vis-a-vis the use of Circuit supervisors can be likened to

what happens in Medical Science. We have the general practitioners that refer special problems to specialist practitioners. My point is that distressed and basic subjects like mathematics should be handled in a special way.

3. Use of Special Mathematical Talents in Schools

Another strategy by which the approach to the teaching and learning of Mathematics can be given a new impetus in the new millennium is to identify special teachers with talents in every school and every circuit. Staff members who have problems in Mathematics could consult these talents for assistance and support. It should be possible sometimes, for such identified talents to sit in colleague's classes to assist in the actual teaching process.

Circuit Mathematics Talents on the other hand have to meet to exchange ideas on pertinent issues that may affect all of them. I should add that, on circuit basis, it should be possible to co-opt secondary school teachers as well as teachers of nearby training colleges.

4. Use of Instructional Aids and Games

Instructional aids and games, when properly employed make learning and teaching spontaneous, effortless and quite enjoyable. Rather unfortunately the use of these materials is on the decline.

Apparently some teachers consider time and artistic skills as limiting factors. It is however worthy to note that aids include physical objects. Besides artistic beauty is secondary when preparation of aids are concerned.

In any case where special talents are tapped in an institution, it should b possible to get a few teachers to take care of the aids aspects of teachers' work. It is known from experience that some students also have special artistic skills that teachers can use.

Another alternative strategy is to organise workshops for teachers on the preparation and use of aids and games in the schools. During such workshops, participants could he encouraged to come out with suggestions for discussion.

5. Liberalization of textbook situation in schools

It is known that many textbooks are in short supply in the schools. The system where approved textbooks are not meant for sale is creating problems particularly for the distressed subjects. I believe a two-tire system where copies of the books are put on the market for those who can afford to buy them should be encouraged. Just as there are poor parents who can not afford to buy the books so are there others who have the means and are willing to buy the books.

6 *Formation of Mathematical clubs*

Pupils and students in schools should be encourage to form such clubs in order to arouse the interest of students in the subject.

7. Increasing the intake of teachers who train in the teaching of Mathematics:

On a more permanent basis, there is the need to give serious attention to the number of teachers trained to handle mathematics in second cycle institutions. For now, there is a shortage of mathematics teachers in the system, and more especially in the new senior secondary schools. It should therefore be seriously considered to increased intake of personnel to pursue mathematics courses to cater for both basic and second cycle schools. When this is done it would get interested and knowledge people to take care of the handicaps of students and thereby putting the subject on the proper keel.

Conclusion

In conclusion, Mr. Chairman, Delegates, distinguished Ladies and Gentlemen, to say that Mathematics is a basic subject which every student should show interest in is a statement of fact. Officially there is much concern and interest shown in the subject. The new millenium would require mathematical brains to tackle the challenges therein. As an association we need to load the crusade, the effort must be sustained, every available resource must be tapped to the full and together mathematics teaching and learning can be rejuvenated and the beneficiaries or a

rejuvenated Mathematics cover everybody, from, the highest to the least.

Thank you.

Extracts from the Secretary's Report

KOJO ABIW-ABAIDOO, NATIONAL SECRETARY

During the period under review, there were five Executive Meetings, of which three were Council Meetings. The meetings deliberated on a number of issues set out as follows:

i. 26th Annual General Meeting (AGM) at St. James' Seminary , Sunyani
ii. Handing over to the New Executive
iii. Appointment of a President
iv. Workshops for writing senior secondary, and basic, school mathematics textbooks
v. Nyansapow Magazine/Newsletter
vi. Consultative Council of Teachers' Association (CCTA)
vii. 6th National Delegates Conference at St. Paul's Secondary School, Denu.

Committees

As a constitutional demand, the following committees were formed by the Council as its advisory bodies:

FINANCE COMMITTEE

The following members were appointed to constitute members of the committee:

i.	Treasurer	Chairman
ii	Mr. MC Gaisei	Member
iii	Mr. K.Addae-Wireko	Member
iv.	Mr. I. A. Ahinful	Member
v,	Mrs. A. Koranteng	Member

The committee is to advise the council on financial matters.

PROJECT COMMITTEE

The following members were appointed to constitute membership of the above committee:

i.	Dr. Kofi Mereku	Chairman
ii.	Mr. E.B, Dogbe	Member
iii.	Prof. N.K. Kofinti	Member
iv.	Mr. S.E Amisaah	Member
v,	Mr. S.D Gyang`	Member
vi.	Miss C. Kisiedu	Member
vii	Mr. E.K. Darko	Member

Suggested areas that the committee will have to explore for income include:

i. Re-introduction of the Newsletter
ii. Introduction of Mathematics Laboratories (i.e. model mathematics centres) in districts
iii. Book Writing and Publishing of Manuscripts found acceptable by the Association's editorial board.

WORKSHOP COMMITTEE

The following members were appointed to constitute the membership:

i.	National Vice Chairman	Chairman
ii	Organising Secretary	Secretary
iii	Chairman-Volta Region	Member
iv.	Secretary – Volta Region	Member
v.	Chairman-Greater Accra Region	Member
vi	Secretary-Greater Accra Region	Member

The committeee is to plan and organise the following workshops:

(a) Delegates workshop/conference in August 1999 in the Volta Region
(b) General workshop/conference in August/September 2000 in Accra. The millennium workshop/conference will also mark the 40th Anniversary of the Association.

WRITING WORKSHOP

SSS Textbooks:

As members are aware the books 1 and 2 of the series are already on the market for sale. Our publishers have assured us that the book three will ready by the end of the year.

Basic School Textbooks

The proposed writing project with partnership with SEDCO Publications took off in October, 1998. There had been a number of workshops since this period.

The membership of the writing teams are as follows **Primary Books 1 - 3**

i.	C M B. Biritwum	Headmistress, RC JSS Offinso- Ashanti
ii.	Ofosu Baabu	Circuit Supervisor, Maths Co-Ordinator, Koforidua
iii.	Issac. A. Ahinful	District Maths Co-ordinator Agona Swedru
iv.	Adwoa Nkrumah	Tutor, Adulrom Sec. Tech. Sch. Adukrom
v.	Agnes Koranteng	Mathematics Co-ordinator, Metro Education Office
vi.	Issac. A. Ahinful	District Maths Co-ordinator Agona Swedru
vii.	Adwoa Nkrumah	Tutor, Adukrom Sec. Tech. Sch. Adukrom
viii.	Agnes Koranteng	Mathematics Co-ordinator, Metro GES Accra
Primary Books 4 - 6		
i.	Kofi Anyimadu	Second Cycle Co-ordinator, GES Konongo
ii.	P. Akuamoah Boateng	Circuit Supervisor, Effiduasi-Ashanti
iii.	L B Dakubu	Circuit Supervisor, Nkoranza
iv.	Faustina Naah	Teacher, Buokrom M A JSS A, Kumasi
v.	Aloysius. N. Addeh	Regional Examinations Officer, GES Bolgatanga.
Junior Secondary Books 7 - 9		
i.	Klaye M K	Teacher, Junior Secondary School, Accra
ii.	G K Mensah	Tutor, Mfantsipim School, Cape Coast
iii.	N W Archer Kwadwo	Tutor, Mfantsipin School, Cape Coast
iv.	S A Gyimah	Lecturer, Maths Department, UST, Kumasi
v.	Evelyn Oduro	Tutor, Holy Child Training College –Takoradi
Local Editor		
	Mr. Eric Wilmot	Department of Mathematics Education, UCC, Cape Coast.

KOJO ABIW-ABAIDOO
(NATIONAL SECRETARY)

Report from the Greater Accra Branch on Activities from December 1998 to March 1999

As the Regional Executive meeting held on December 17, 1998, a timetable was drawn for a workshop/meeting for the Primary, JSS and Senior Secondary schools mathematics teachers in the Greater Accra Region.

The workshop for primary /JSS schools in the Accra District scheduled for 4th February 1999 was postponed to Thursday 18th February 1999. Two resource persons, Mr. Owusu Asiamah from the Inspectorate Division of the GES and Mr. M.M. K. Klaye, MAG Chairman for Greater Accra, gave lectures on some practical methods of teaching. Some essentials in teaching mathematics namely learning/teaching materials, attitude of teachers and class activities were emphasised. There was also brief information on MAG, its formation, aims, membership, constitution, etc. The open forum centred on some problems facing teachers, inadequate number of textbooks and some problems with teaching measurement.

The workshop for primary/JSS schools in the Dangbe-East scheduled for February 14, 1999 could not come on.

The workshop for senior secondary schools in the Accra District took place as scheduled on Thursday March 11, 1999 and was attended by 24 teachers. Mr. E. B. Dogbe, Mr Owusu-Asiamah, Mr J. N Awuah and Mr M K Klaye, who were the resource persons, covered the following topics:

1. Common errors made by students in the SSSCE examinations and the role of teachers in the classroom in overcoming such problems;
2. Test writing in 3-dimensional problems in mensuration and trigonometry;
3. Some areas which students find difficult, especially in elective mathematics, like binary operations, rational expressions, and probability; and
4. Recent Studies in mathematics teaching.

The workshop for senior secondary school in the Ga District came on as planned on Thursday March 11, 1999. It was so successful that participants expressed the desire for another one. The Executive was therefore considering the inclusion of the Ga District schools in the workshop that it would organise for the Dangbe West schools.

Report from the Eastern Regional Branch

Executives

Chairman	Mr. Emmanuel Ofosu-Boabu
Secretary	Mr. Godfred K. Tettey
Treasurer	Miss Comfort Yamoah
Assistant Secretary	Mr. S.A Addo
Organising	Mr. Hansen Otu-Ofosu

MAG Conference and Workshop 1999

For the year 1999, a confrence workshop was held at Koforidua Secondary Technical school Koforidua on July 2, 1999. The theme for the conference *was 'Appropriate Inquiry an Asset Approach to Work in Schools'.*

The welcome address was delivered by the Assistant Headmistress of Koforidua Secondary Technical School, Koforidua, Ms. Sophia Amable. The Conference was chaired by Mrs. Osafo-Afum, who stepped in for the Acting Regional Director of Education, Eastern Region, Miss Susam Rosemary Kennedy, who could not attend the conference.

The Guest speaker was Dr. Barbara Gardner Yaa Boatema IILP Teacher Trainer Advisor. She spoke on two ways to approach working in schools.

1. Problem solving

   A Identify the problem

B Analyse its cause

C, Analyse possible solutions

D Plan for Action

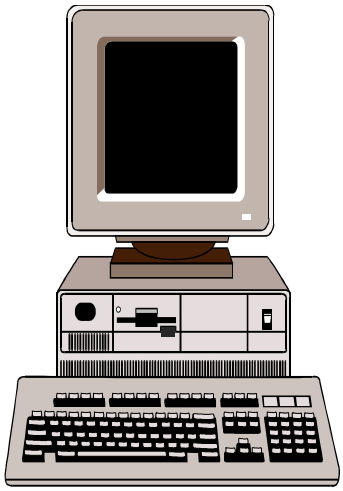
2. Appreciative Inquiry

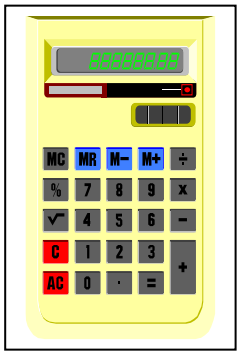
She said using appreciative inquiry energizes people to work on their won problem in a creative and hopeful way.

The workshop aimed at addressing the problem areas of the mathematics syllabus at the primary/JSS and SSS/Training college levels. At the lower primary the lecturers were Miss Adwoa Nkrumah and Agra Koranteng, At the Upper primary, Mr Ofosu-Boabu, and at the JSS was Mr. A A Piniamang. Mr. S.K. Bosompem led the discussion at the SSS and Training College level.

Attendance at the conference was one of the best for years. Members present were 145 and about 80 new members were registered.

The message from the National Chairman of MAG was read by Miss Adwoa Nkrumah, the National Treasurer.





MORE REAL MATHEMATICS IN THE REVIEWED BASIC SYLLABUS

- Investigations
- Calculators
- Interest rates,
- Simple interest,
- Bank Charges
- Insurance Premiums and Benefits.
- Income tax & Taxable Income
- Value Added Tax (VAT)
- Custom duties.
- Import or excise duty

27TH NATIONAL BIENNIAL CONFERENCE & 40TH ANNIVERSARY CELEBRATION

THEME: Mathematics as a Tool for National Development in the Computer Age

KEYNOTE ADDRESS: His Excellency PROFESSOR JOHN ATTAH-MILLS, Vice President

Guest Speakers:

Hon. Minister Of Education, Mr. Ekow Spio Garbrah

Prof. C. Akumfi-Ameyaw, Director General, GES

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Mr. S. E. Amissah, GES Headquarters, Accra

Mrs B. Osafo-Affum, GES Headquarters, Accra

Date

AUGUST, 27 - 31 2000

Venue

COMMONWEALTH HALL

University of Ghana Legon

CALL FOR PRESENTERSi

Presenters who would like to lead discussions or make presentations during the conference should send abstracts of their presentations (of not more than 120 words) on any of the above theme/sub-themes to the address below by Friday, July 21, 2000: *THE SECRETARIAT,*
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